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## COVER SHEET

### Access 5 Project Deliverable

**Deliverable Number:** CCC008

**Title:** UAS Frequency Spectrum & Bandwidth Whitepaper for WRC 07

**Filename:** CCC008\_UAS Spectrum Requirements\_FINAL2.doc

#### **Abstract:**

A critical aspect of the Access 5 program is identifying appropriate spectrum for civil and commercial purposes. However, currently, there is no spectrum allocated for the command/control link between the aircraft control station and the unmanned aircraft. Until such frequency spectrum is allocated and approved, it will be difficult for the UAS community to obtain civil airworthiness certification and operate in the NAS on a routine basis. This document provides a perspective from the UAS community on Agenda Items being considered for the upcoming World Radiocommunication Conference 2007 (WRC 07). Primarily, it supports the proposal to add Aeronautical Mobile (Route) Services (AM(R)S) to existing bands that could be used for UAS Line-of-Sight operations. It also recommends the need to identify spectrum that could be used for an Aeronautical Mobile Satellite (Route) Service (AMS(R)S) that would allow UAS to operate Beyond Line-of-Sight. If spectrum is made available to provide these services, it will then be incumbent upon the UAS community to justify their use of this spectrum as well as the assurance that they will not interfere with other users of this newly allocated spectrum.

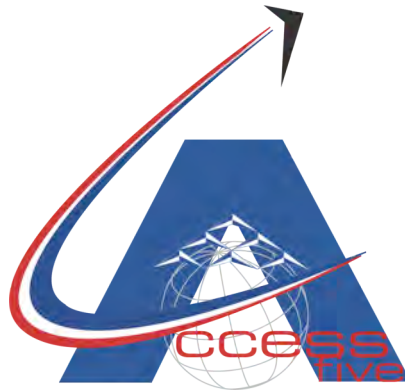
#### **Status:**

<b>WP – Work in Progress Draft</b>

#### **Limitations on use:**

This document represents the thoughts and ideas of the C3 Work Package team. It has not been reviewed or approved as an Access 5 project position on this subject. Additional research and analysis is required to identify and/or validate appropriate frequencies and bandwidth requirements for line-of-sight command & control. In addition, the spectrum requirements for cases where the unmanned aircraft and control station are beyond-line-of-sight, still need to be addressed. Limited input is also available on estimated projections of UAS in the NAS within a specified timeframe. Only a rough estimate of C2 potential bandwidth is made. No estimate of payload impact on the spectrum is provided.

*The following document was prepared by a collaborative team through the noted work package. This was a funded effort under the Access 5 Project.*



**ACCESS FIVE WHITE PAPER**

**TO**

**THE WRC ADVISORY COMMITTEE**

**February 15, 2006**

Prepared by:

The Command, Control, Communications  
Work Package (WP06)

*The following document was prepared by a collaborative team through the noted work package. This was a funded effort under the Access 5 Project.*

# **Frequency Allocations for Unmanned Aircraft Systems In the National Airspace**

## **1. INTRODUCTION**

The intent of this white paper is to provide the WRC Advisory Committee (WAC) an unmanned aircraft systems (UAS) perspective on current agenda items for the upcoming World Radiocommunications Conference 2007 (WRC 07). The NASA Access 5 Project, whose goal is to obtain routine access for UAS in the National Airspace System (NAS), believes strongly in the importance of operating UAS on frequencies approved for aeronautical communication and that meet the Federal Aviation Administration (FAA) safety requirements. However, currently, there is no spectrum allocated for the command/control link between the aircraft control station and the unmanned aircraft. Until such frequency spectrum is allocated and approved, it will be difficult for the UAS community to obtain civil airworthiness certification and operate in the NAS on a routine basis. Therefore, it is our hope that the WAC will consider this white paper when establishing positions on current and future agenda items.

## **2. AGENDA ITEM 1.6**

Over the past years, it has become increasingly difficult to manage the bandwidth allocated for aeronautical communication services due to increased traffic. This difficulty will further be exacerbated as unmanned aircraft and other new technologies begin flying routinely in the NAS. As a result, Agenda Item 1.6 proposes adding two spectrum bands where aeronautical mobile route services, AM(R)S, can be added as an additional primary purpose. Access 5 recognizes this and supports the effort to allocate additional spectrum for aeronautical purposes.

Currently, there is an on-going Access 5 technical study to determine whether the two bands identified (960 – 1 024 MHz and 5 091 – 5 150 MHz) could support UAS operations. If it is found to be compatible with systems operating in and around those frequency ranges such as Distance Measuring Equipment (DME) and the Microwave Landing Systems (MLS), the UAS community could potentially operate a Line of Sight (LOS) system in these frequency ranges.

Although not specifically identified in the draft proposal, Access 5 would like to propose that a portion of the spectrum identified in Agenda Item 1.6 be “reserved” for the command/control of unmanned aircraft. It is difficult to identify exactly how much bandwidth will be required for future UAS operations; however, one UAS manufacturer estimates approximately 20 MHz of spectrum to support approximately 1,000 unmanned aircraft in the NAS. For example, if 1 000 MHz – 1 020 MHz was proposed for future UAS operations, the UAS manufacturers could begin evaluating and potentially designing communications suites that would operate in this frequency range.

### **3. AGENDA ITEM 1.5**

Another agenda item that Access 5 has evaluated is Agenda Item 1.5, which considers additional spectrum for aeronautical telecommand and high bit-rate aeronautical telemetry. According to a draft proposal for this agenda item, it was not intended to be used to command/control unmanned aircraft.

However, it does relate to another UAS issue, which is the need for bandwidth for payload-related data. Although this is not an area of emphasis for Access 5 at this time, the bandwidths identified for aircraft telemetry in Agenda Item 1.5 could potentially be used for UAS payload information. Since it is very close to frequencies being used by commercial satellites, the operations may be limited to small geographic areas related to the test and evaluation of UAS communication systems.

### **4. FUTURE AGENDA ITEMS**

Finally, Access 5 is asking the WAC to consider a future agenda item to identify spectrum that could be used for Beyond Line of Sight (BLOS) operations. Besides having an extended loiter capability, another benefit of UAS is the ability to command/control the unmanned aircraft from a distant location. This would require spectrum to support an aeronautical mobile satellite route service, AMS(R)S. Currently, no spectrum is identified or proposed to support this capability.

Similar to Agenda Item 1.6, if AMS(R)S spectrum is allocated to the future development of unmanned aircraft, UAS manufacturers could begin evaluating potential architectures. For that reason, Access 5 has begun evaluating current satellite and ground based networks that might be able to provide a safe and secure BLOS service.

### **5. CONCLUSION**

Access 5 is grateful for the opportunity to comment on the proposed Agenda Items for WRC 07. Access 5 would also encourage the committee to continue to work with the UAS community in identifying spectrum for UAS operations in the future.